



National Weather Service
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High Plains Herald

The National Weather Service provides weather forecasts and warnings for the protection of life and property and the enhancement of the national economy.

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Greetings from our New Meteorologist-in-Charge

By S. Apfel

Hello everyone, my name is Steven L. Apfel, and I am the new Meteorologist-In-Charge at the NOAA/National Weather Service office in Cheyenne, WY. I am honored and privileged for the opportunity to serve our customers and partners across southeast Wyoming and the western Nebraska panhandle. I was born and raised in Nebraska and attended college at the University of Nebraska, so I have close ties with fam-

ily and community. Growing up in Nebraska in the 1960s sparked my interest in weather and how it impacts our daily lives. I set a goal at a young age to become a meteorologist and carried that goal through the US Air Force and into the National Weather Service. After 25 years of Federal Service from Ohio and Nebraska, to Nevada and Montana, I have kept one value close to my heart, service above self. We

have a staff of 23 professionals who are dedicated 24/7 to meet the mission of the NWS to protect life and property and enhance the national economy. Our promise to you is that we will do our very best to give you the support you need to make an informed decision about weather, water and climate.

Please stop by and visit our office, we would be glad to see you!!

Commemorating the 1985 Flash Flood

By R. Mazur

Members of the Cheyenne WFO staff joined city officials and members of the community to commemorate the 25th anniversary of the deadly flash flood that occurred in the city of Cheyenne on August 1st, 1985. Twelve people lost their lives and 70 were injured during the flood, which also caused some \$61 million in property damage. Roughly 100 people were in attendance for the ceremony which was held at the Laramie County Library in Cheyenne on August 5th 2010. WCM John Griffith presented details on the stationary super cell thunder-



WCM John Griffith with Retired-MIC William Parker (left) speaking about the flash flood in Cheyenne on August 1, 1985.

storm that produced up to seven inches of rain in three hours in the city, with two to six-inches around and outside the city. The storm also produced copious amounts of hail, which was washed into piles four to six feet deep in parts of the city, and also

spawned at least one tornado. Retired-MIC William Parker and Dave Guille (retired emergency manager) shared stories from that fateful night of warning and rescue operations from around the town. Doug Vetter (city engineer) spoke about flood mitigation around the city since the event to prevent a similar tragedy in the future. Lastly, citizens directly affected by the flood shared their stories of tragedy and of triumph that night. All were a humbling reminder of the power generated by fast moving water in a flash flood.

Spring Flooding

By M. Weiland



Flooding on the Laramie River in Laramie

"the large amount of water filled many of the large reservoirs for the first time in many years"

Significant flooding occurred this past June over many of the rivers and streams that flow off the Snowy Range. This included the North Platte, Laramie, Encampment and Medicine Bow Rivers and many of their tributaries. The flooding began around June 8 and continued through the last half of June. The river gage on the North Platte River at Henry did not fall below flood stage until July 10.

Record flooding was recorded on the Laramie River at Laramie, where a peak of 6.6 feet was reached on June 14. The previous record stage at that

location was 5.3 feet. In addition, the river gage on the North Platte River at Sinclair reached record flood stage. The river at that point climbed to 11.7 feet on June 16. The previous record stage at Sinclair was 11.3 feet.

The flooding caused water to seep into basements of houses in Saratoga, Laramie, Medicine Bow and Henry. A campground on the Encampment River at Riverside also experienced flooding. Luckily, there were not any significant flooding problems along any of the rivers in June. This was mainly due to advance preparations by the state, county and local officials who had sandbags and equipment in place prior to the flooding.

The flooding was caused by a combination of a large snow-

pack in the Snowy Range through May, cool temperatures that month and then rainfall over a rapid warm up at the end of May and early June, which all led to rapid snowmelt starting in early June on the rivers flowing out of the Snowy Range.

Even though the flooding caused many short term problems in June, the large amount of water filled many of the large reservoirs for the first time in many years and provided adequate water for all users



Near Riverside on the Encampment River

La Niña Winter

By R. Emanuel

Here is an outlook on the upcoming fall/winter season to help you get prepared. Last season, an El Niño year, was quite cool and snowy with the second highest seasonal snowfall, around 103 inches, recorded in Cheyenne.

The typical effects of El Niño for this region are higher than average precipitation (verified) and a slight tilt towards warmer than average temperatures (did not happen). The El Niño temperature effect

was strongly overridden by a second event known as the Arctic Oscillation, which allowed cold polar air to repeatedly surge into much of the country last winter. So we had the cold from the AO but the moisture from El Niño, which is why much of the country was cold and snowy last winter.

El Niño is gone and it's opposite, La Niña, has developed and is expected to be of at least moderate strength through this winter. In the absence of other factors, typical La Niña climatology in this area is for cooler and drier than average conditions, and unfortunately, windier than average conditions.

Attached is a chart that depicts how temperatures turned out for La Niña events in this area over the last 40 years.

The other event near and dear to the hearts of those who have been here a while is our typical fall-spring breezes. La Niña typically brings an enhancement to the gentle breezes, with a quick calculation showing about a 35-40% increase in windiness as opposed to El Niño seasons, like last season was. For the period October through April, La Niña years have averaged about 73 days with wind gusts at least 40 mph here in Cheyenne, as opposed to El Niño years which have averaged about 55 days. The effect is a little more pronounced for gusts of 50 mph or greater, with La Niña seasons averaging about 30 days vs. 18 days during El Niño. Needless to say we should continue our streak of not issuing any air stagnation advisories.

That's about it, In summary, think snow?!!

> 2.0 degrees above average

Between 1 and 2 degrees above average

Within 1 degree of average

Between 1 and 2 degrees below average

> 2.0 degrees below average

seasonal snowfall, recorded in 6

The typical effects of

Oct-Mar and Dec-Feb Temperature Anomalies

La Nina Years

	Cheyenne		Rawlins		Scottsbluff	
	OCT-MAR	DEC-FEB	OCT-MAR	DEC-FEB	OCT-MAR	DEC-FEB
Avg Temp	33.5	28.5	29.1	23.1	34.3	27.8
2008-2009	35.1	29.3	30.5	24.0	35.5	28.8
2007-2008	32.9	25.5	27.0	18.1	32.8	26.0
2000-2001	31.2	26.6	24.7	18.8	32.3	26.2
1999-2000	37.5	32.2	36.4	30.2	38.6	32.9
1998-1999	35.8	30.7	34.2	27.9	37.3	31.8
1988-1989	33.2	25.4	28.6	19.1	33.4	25.6
1984-1985	30.0	23.3	25.3	17.6	32.4	23.7
1975-1976	34.2	30.7	29.0	24.0	36.2	31.3
1974-1975	31.9	25.7	27.6	19.5	33.6	26.7
1973-1974	34.5	28.4	28.9	21.0	34.0	26.4
1970-1971	32.3	28.1	27.9	23.3	32.4	27.0
1964-1965	32.3	29.1	27.3	23.0	32.9	28.1
1955-1956	32.6	27.5	28.7	23.1	32.6	26.0
1954-1955	32.9	26.8	27.4	20.1	32.9	25.3
1950-1951	34.0	28.9	M	M	34.9	29.6

Aviation Forecasting

By G. Claycomb

Next to issuing warnings and re-source protection duties, the most important service a weather office performs is aviation forecasts to airports in their area of responsibility. Depending on weather conditions, airlines have to carry additional fuel which increases operating costs and could decrease the amount of passengers they carry on a given flight. Additional costs eventually get passed onto their customers. The Cheyenne office supports 7 airports in southeast Wyoming and Nebraska Panhandle. Our four airports in Nebraska are

Chadron, Alliance, Scotts Bluff and Sidney. In southeast Wyoming, Cheyenne, Laramie and Rawlins we provide 24 hour Terminal Aerodrome Forecasts (TAFs), issuing these TAFs every six hours, 365 days a year. A forecaster is dedicated to TAF support at all times. This forecaster is responsible for updating the TAFs as needed should the weather change from what is forecast in the TAF. Topography plays a huge role in how clouds and weather forms in this area of the country, with low clouds and fog more common in

the Nebraska Panhandle. The Front Range can either provide upslope conditions resulting in low clouds and enhanced precipitation, or it can produce down sloping conditions that produce clear skies and warm temperatures, depending on the prevailing winds. As you can imagine, WFO Cheyenne's aviation support is very challenging with our 7 airports ranging in elevation from 3298 feet at Chadron to 7284 feet at Laramie. Our aviation forecasters have to take terrain and elevation factors into account, which makes aviation forecasting a very challenging endeavor.

"The Cheyenne office supports 7 airports in southeast Wyoming and Nebraska Panhandle."

Just For Fun

D	I	N	S	T	A	T	N	O	R	F	I	N	F	I	L	I	B
O	N	T	P	R	N	O	D	A	W	I	R	N	H	C	T	A	W
W	Z	I	W	I	N	R	F	L	O	E	O	D	T	H	R	E	M
N	O	M	W	T	E	N	R	F	L	O	N	T	S	O	R	M	T
B	P	R	A	E	C	A	P	P	I	T	A	T	M	R	O	T	S
U	D	O	R	W	N	D	P	B	U	R	S	E	T	H	U	M	D
R	I	D	N	I	T	O	Y	O	V	R	T	A	S	F	X	Y	U
S	C	L	I	Y	D	U	I	D	E	E	S	W	A	L	T	H	O
T	W	A	N	T	R	N	I	T	R	N	G	Z	U	O	U	O	L
D	O	T	G	I	P	P	E	R	A	D	V	I	S	O	R	Y	C
H	A	S	I	D	L	M	C	I	R	T	C	U	L	D	A	T	I
A	B	A	L	I	O	T	Y	L	I	G	I	H	T	N	I	N	G
T	L	C	O	M	R	A	D	O	I	N	D	P	P	L	O	O	D
C	I	R	R	U	L	A	L	I	G	H	T	N	I	N	G	T	H
E	A	E	R	H	X	M	E	T	E	T	B	A	R	C	F	R	O
P	H	V	C	I	P	I	T	A	T	S	T	O	R	N	E	D	B
T	U	O	R	S	I	N	S	T	A	B	I	L	I	T	Y	R	S
T	H	U	N	O	I	T	A	L	U	C	R	I	C	M	I	D	P

- INSTABILITY
- LIGHTNING
- TORNADO
- WIND
- FLOOD
- THERMOMETER
- BAROMETER
- FRONT
- PRECIPITATION
- STORM
- DOWNBURST
- HUMIDITY
- OVERCAST
- CLOUDS
- WATCH
- WARNING
- DOPPLER
- HAIL
- ADVISORY
- CIRCULATION

Answer key is on the last page.

What is CoCoRaHS?

By M. Weiland

CoCoRaHS (which stands for Community Collaborative Rain and Hail Study) is a way for people to record and report the rain, hail and snow amounts that they receive at their house. It was started shortly after the 1997 Ft. Collins flood by the Assistant State Climatologist in Colorado. That flood showed the need for a much denser network of rainfall reports. Since that time, the volunteer group of interested citizen precipitation reporters has grown to over 5,000 people across

the entire nation. Here in southeast Wyoming and the western Nebraska panhandle there are about 200 people who report the rain and snow that they get each day. This number of dedicated volunteers continues to grow and the good news is that we are always looking for more people reporting daily precipitation. The cool thing is that your information is entered on a website and then is

displayed and anyone around the country can see your rain or snow amount. The information is used by researchers, water managers and the National Weather Service. If you'd like to join CoCoRaHS, just go to the website at www.cocorahs.org. On the left side there is a tab labeled "join CoCorahs". For more information, you can go to the website or call Mike at 307-772-2468 ext. 516.



"...we are always looking for more people reporting daily precipitation."



you can find the

"In Depth" Snow

Measuring

presentation at:

<http://>

www.cocorahs.org/

[Content.aspx?](http://www.cocorahs.org/Content.aspx?)

[page=training slide](http://www.cocorahs.org/Content.aspx?page=training_slide)

[shows](http://www.cocorahs.org/Content.aspx?page=training_slide)

15
Years

We would like
to recognize
Stanley Rennard
for fifteen years
of Volunteer
Service.

Thank You!

CoCoRaHS Snow Reporting

By A. Hutcheon

Reporting snow brings many questions and a few curious and confusing reports. Here is a reminder on how to measure and report snow. Many of you may have seen this before, and hopefully have kept the information as a reference. I will try to be clear and concise, but I highly recommended you view the Snow Measurement Video. For those of you with internet access you can find the "In Depth" Snow Measuring presentation at: http://www.cocorahs.org/Content.aspx?page=training_slideshows.

During the "winter" months we are looking for three main measurements:

Daily Precipitation Amount:

The daily precipitation amount refers to "Rain and/or melted snow (and ice) that fell during the past 24 hours." Here you report the water content of the rain, snow (and ice) that fell in the past 24-hours. In the case of snow (and ice) you must melt the contents of your gauge and pour it into your

inner cylinder for measurement. Remember the water content is reported to the nearest 0.01". DO NOT report the depth of snow as your 24 hour precipitation amount, but do report the water content after the snow has been melted. If you do not measure the water content, or if you happen to spill it (it happens), then please enter "M" for missing. If due to strong winds, or other factors, the amount in the gauge is not representative of what actually fell, then you will need to take a core sample ("cut a biscuit") of the snow and/or ice pellets that fell (How to "Cut a biscuit" is covered in the snow measuring presentation at the CoCoRaHS website. If you use your core sample, rather than your actual gauge catch, be sure to mention that in your "Observation Notes/Remarks". If you add warm water to your snow to speed up melting, then be sure to note the exact amount of warm water you added and then subtract that amount out to get the correct amount of water content from the new snow.

Depth of New Snow:

New snow refers to the snow that has fallen in the past 24 hours. New snow is reported to the nearest tenth (0.1) of an inch. Ideally, new snow should be measured on a snow board or other smooth, level surface, where the snow is even and undisturbed. Use a ruler to measure the snow.

If the snow is drifted and uneven, take an average of several (at least 3) measurements, but avoid including the largest drifts. If all snow that fell melted immediately on contact with the ground and never whitened the ground, report T (trace). If the snow accumulated to some depth, but then melted, settled or blew away, report the maximum accumulation prior to melting, settling, and/or blowing. If it snowed but you did not measure it, then please enter "M" for missing. Report 0.0 for the new snow amount only if it did not snow at all in the past 24 hours.

Depth of all snow on the ground at observation time:

This is the average depth of any snow on the ground (old, new or both) at the time of your daily observation. If there is no snow on the ground, then please enter "0". If it snowed yesterday, but it all melted, then report "0". If there are only patches of snow left on the ground, then report T (trace). If appropriate, take an average of several measurements. When it is cold, and snow has been on the ground for several days, it may be possible to estimate the depth without having to tromp all over your yard every day. Snow depth information is important for many applications, so please measure and enter the total depth of snow on the ground, even if it has not snowed recently.



Wind Chill Warning Events

By J. Lundquist

With summer over, our attention is now turning towards winter weather. One of the types of weather we experience during the cold season are wind chills, which is what temperatures feel like when taking into account the wind.

During wintertime wind chills can become bitterly cold, with values well below zero. By definition, if wind chills go below -30°F a wind chill warning is issued. These warnings are issued when wind chills become life threatening.

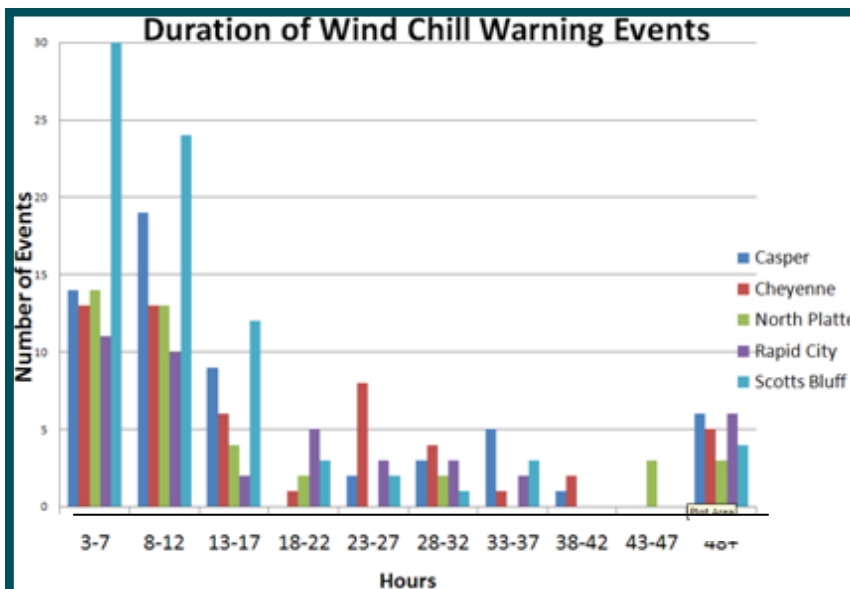
Recently a climatology

of wind chill warnings over the past 40 years was conducted for the Cheyenne NWS office to have a better idea of the duration and frequency of wind chill warnings. The clima-

tology consisted of data from Cheyenne, Scottsbluff, North Platte, Rapid City, and Casper. An "event" is considered to have wind chills of -30°F or

colder for at least 3 hours.

Looking at the graph of Duration for Wind Chill Warning Events, notice that the number of events lasting more than 12 hours drops off significantly; however there is a small increase in the number of events that last two days or longer. To put the graph in perspective, roughly half of the events were up to 12 hours. The events that are longer than 12 hours may last more than 2 days. Also notice that during the same time-frame Scottsbluff has the most events followed by Casper. During the longer events, each of the sites takes a turn at having the most events.



Wyoming Winter Driving

By J. Knutson

"Fall is a great time of year to prepare your vehicles for the coming winter months."



As the seasons begin to change, so do the driving conditions, and so should our driving habits.

Fall is a great time of year to prepare your vehicles for the coming winter months. Here is a minimal checklist for preparing your vehicle for those cold winter months:

Tune up your vehicle

Change your car's oil to a lighter, winter weight, and make sure all fluids are kept FULL.

Have the Radiator system serviced or check it yourself with an antifreeze tester and add antifreeze as needed.

Make sure your brakes are working properly.

Your tires are properly inflated.

Replace old windshield wipers

Use anti-freeze window cleaning fluid.

Have the heater/defroster checked to ensure its in working order.

Check the battery and terminals to be sure there are no leaks, damage, or corrosion.

Check all lights to be sure that they are working correctly.

Be sure to keep your fuel tank full. To avoid ice in the tank and fuel line. (running out of fuel during winter months can put you in a bad situation).

Remember!!!!

Adjust speed for road conditions.

On wet roads, motorists should reduce their speed by 5-10 miles an hour.

On snow packed roads, reduce speed by half.

When roads are icy, speed should be reduced to a crawl, or even slower if there is traffic ahead, to maintain a steady flow of traffic.

Be Safe out there and have a Wonderful Wyoming Winter!!

2010 Summer Season Warning Review

By M. Jamski

Severe thunderstorms generated 80-mph winds north of Cheyenne on May 9. Intense low pressure over northern Colorado triggered severe thunderstorms in southeast Wyoming on May 18. A tornado touched down south of Cheyenne but dissipated as it approached the city. Other tornadoes were observed near Pine Bluffs and Burns. Widespread reports of very large hail and straight-line winds occurred in the Nebraska Panhandle on May 24. Softball size hail caused property damage near Kimball. Severe thunderstorms produced large hail and damaging

winds northwest of Cheyenne on May 26.

Severe thunderstorms produced large hail on June 1. Tornadoes touched down near Bayard and Scottsbluff on June 7. Large hail and flash flooding occurred on June 9 in the Panhandle.

Thunderstorms on July 3-4 generated high winds, tornadoes, large hail and flash flooding. Bridgeport suffered extensive damage to grain bins, a radio tower, trees and crops. Torrential rain produced significant flash flooding at Lodgepole, Nebraska on

July 6-7. A long-track supercell thunderstorm on July 19 deposited dollar to baseball size hail across the Panhandle.

Severe thunderstorms on August 3 dropped hail in Niobrara County. Thunderstorms produced 60 mph winds at Sidney on August 9. Large hail fell north of Wheatland on August 16.

To summarize, there were 396 severe weather reports in the NWS Cheyenne CWA: 274 hail, 54 thunderstorm wind, 34 tornado, and 34 flash flood.

Tornado south of Cheyenne, WY on May 18, 2010



We would like to recognize **Sonia & Jeff Cottrell** for fifteen years of Volunteer Service.

Thank You!



Kalamazoo, Michigan Oil Spill (Photo Courtesy of the Sierra Club of Michigan)

Incident Support

By S. Carpenter

The Cheyenne forecast office has traditionally supported one member of the staff specially trained to go to wildfires and other incidents to provide weather briefings and forecasts to incident management teams as the Incident Meteorologist (IMET). Of the current staff members, Mike Weiland, Kevin Daugherty and John Griffith have provided IMET support to a variety of incidents in the past. Scott Carpenter took over this role in 2008 after the previous IMET, Mike Sowko, took a position at a NWS National Center in Silver Spring, MD. IMET decision support services ensure the safety of operations personnel and allow the incident management team's command staff to plan effective operations for upcoming operational periods. During the relatively slow 2009 wildfire season in the continental United States, Scott was dispatched to one training incident at the Tumblebug Complex of wildfires near Oakridge, OR. His second training assignment was completed this summer at the South Ridge wildfire near Espanola, NM where he earned his IMET certification. Scott then volunteered to spend a week in August providing incident support to the Environmental Protection Agency and U.S. Coast Guard during the clean-up of

an 800,000 gallon oil spill from a pipeline into the Kalamazoo River near Marshall, MI.

The NWS currently has a cadre of around 80 IMETs nationwide and this program dates back nearly one-hundred years to 1914 when the Weather Bureau first started preparing forecasts specifically for the fire community. Response to high impact national events such as Hurricane Katrina and the 2010 Gulf of Mexico oil spill also show the need for critical weather information support for the entire emergency management community. NOAA has invested additional resources in the IMET program in recent years that will allow faster incident response times and increased forecast accuracy during critical events. In addition, the entire Incident Meteorologist program is being supported with new capability to respond not only to coastal incidents, but to high impact environmental all-hazard events, such as this summer's Kalamazoo River oil spill. IMET dispatches also impact the entire forecast office staff, since other staff members have to sacrifice to work the shifts vacated by the incident meteorologist providing on-site support.

“Women In Science”

By R. Mazur



Jim Knutson and Steve Eddy watching students with the Van der Graaf generator.

Junior high and high school students from across the state of Wyoming were treated to a day of science exploration and learning at the 2010 Women in Science, sponsored by the Wyoming NASA Space Grant Consortium and the University of Wyoming. The event was held in the UW Student Union on May 11th and over 100 students were in attendance for the day-long event. Presentations and hands on activities were conducted through the day to open up the students’ eyes to various careers in science, mathematics, and technology fields.

My friend and colleague, Victoria Sankovich, and I led two breakout sessions where we spoke about our careers as meteorologists for the government (Bureau of Reclama-

tion and NWS, respectively). We also had the students perform three experiments to learn a little bit about how the atmosphere works, in addition to taking basic weather observations. Specifically, the students took measurements of dry and wet bulb temperatures in addition to observations of weather, sky cover and visibility. The second lab demonstrated

an unstable atmosphere and convective mixing conducive to thunderstorm development. This was done by placing an ice cube dyed with blue food coloring in warm water dyed red. The students watched as the blue water sank and red water rose as the mixing cycle ensued, which we related to thunderstorm development. The final lab demonstrated scattering of light particles in the atmosphere into different colors to answer the questions “why is the sky blue?”, and “why are sunsets red and orange?” This was done by adding milk to a jug of water and shining a flashlight at different angles on the liquid mixture in the jug. The color of the mixture changed from a purple/bluish tint to a more red/orange hue as more milk particles were

added to the mixture. Thus we were able to simulate the scattering of sunlight as the sun travels from high noon (where the light travels through less atmosphere and scatters blue wavelengths), to sunset (when light travels through more atmosphere at a higher zenith angle and scatters wavelengths near orange and red).

We then participated in the career panel where students could ask the panelists’ questions regarding our careers in science and what it’s like to be a working woman.

Throughout the day, booths were stationed in the main lobby for the students to learn about specific science, math, and technology related organizations. From our office, Jim Knutson, John Griffith, Debbie Winston, Scott Carpenter, and AMIC Steve Eddy spent the day zapping students with the Van der Graaf generator, demonstrating the dynamics of a tornado with the tornado machine, and talking about weather in general.

All in all, fun was had by those involved, and the students left UW with a better knowledge of careers in science, math, and technology.

“the students left UW with a better knowledge of careers in science, math, and technology.”



We would like to recognize Kristina Bell for fifteen years of Volunteer Service.

Thank You!



We would like to recognize Preston Richards for fifteen years of Volunteer Service.

Thank You!



Rebecca Mazur teaching students about taking weather observations.

2010 Summer Season Review

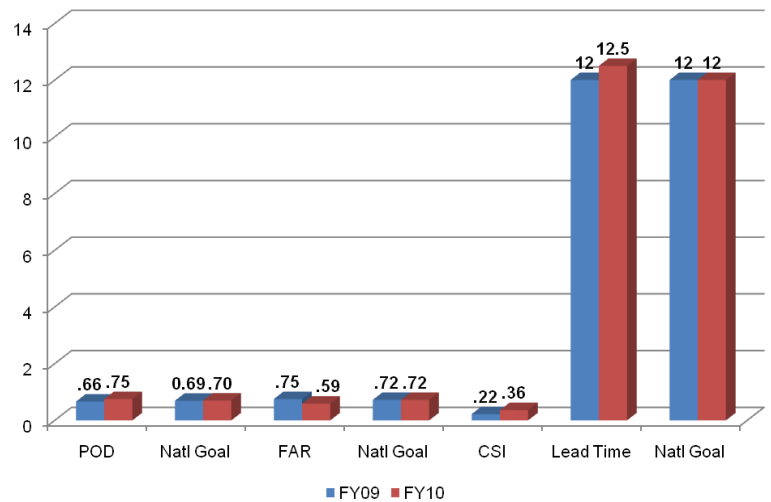
The NWS is monitored for its performance via national GPRA (Government Performance and Results Act) goals each fiscal year. Benchmarks were established for tornado (TOR) and flash flood (FFW) warnings. In FY09, GPRA metrics for TOR accuracy (POD) was 69%, false alarm ratio (FAR) 72%, and lead time 12 minutes. For FFW, accuracy was 90% and lead time 49 minutes. FY10 TOR POD rose to 70%, and FFW POD and lead time

decreased to 72% and 38 minutes, respectively. Figures 1 and 2 depict a two-year comparison of CYS and GPRA metrics. There was improvement in all categories from FY09 to FY10. FY10 FFW statistics revealed a marked increase in lead time. Better situational awareness, pattern recognition, and more aggressive verification methods were crucial to this year's success.

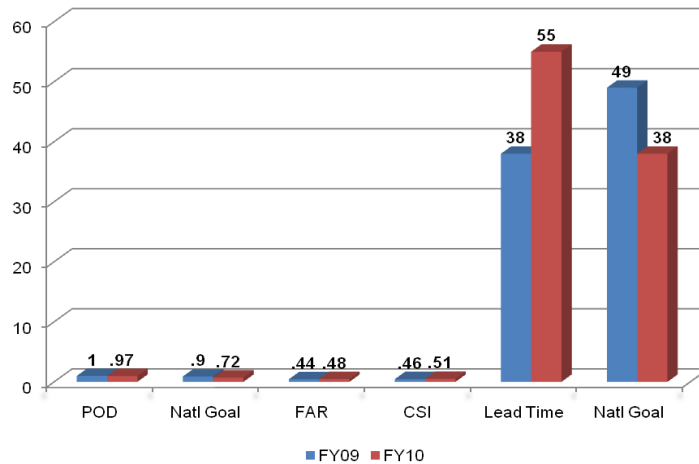
By M. Jamski

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WFO CYS Tornado Warning Performance



WFO CYS Flash Flood Performance



15
Years

We would like
to recognize
Raul Aguallo
for fifteen years
of Volunteer
Service.

Thank You!

Calendar of Events:

November 4—Nebraska Winter Weather Awareness Day.

November 27—5:00 PM: Cheyenne Christmas Parade—come out and join us!

December 21—Winter Solstice

Just for Fun Answers:

D				T	N	O	R	F				B
O	N			O				R	H	C	T	A
W		I		R			E				R	
N			W	N		L				O		
B		A		A	P				M	R	O	T
U		R		N	D	P			E			D
R		N		O				R	T		F	U
S		I	Y	D	I		E	E			L	O
T		N	T				T	R			O	L
		T	G	I			E	A	D	V	I	S
		S	D		M			T			D	
		A		I	O				I			
		L	C		M				P			
		I	R	R	U			L	I	G	H	T
		A	E		H						C	
		H	V								E	
		T		O				I	N	S	T	A
				N	O	I	T	A	L	U	C	R

INSTABILITY
LIGHTNING
TORNADO
WIND
FLOOD
THERMOMETER
BAROMETER
FRONT
PRECIPITATION
STORM
DOWNBURST
HUMIDITY
OVERCAST
CLOUDS
WATCH
WARNING
DOPPLER
HAIL
ADVISORY
CIRCULATION